

REMARKS**1. Request for Continued Examination:**

5 The Applicant respectfully requests continued examination of the above-indicated application as per 37 CFR 1.114.

10 **2. Response to the rejection of claims 1, 5-7, 16 under 35 U.S.C. 102(a):**

Claims 1, 5-7, 16 are rejected under 35 U.S.C. 102(a) as being anticipated by Ishii (J.P. 2001-257289).

- 15 ● Regarding claims 1 and 6, Ishii discloses a semiconductor device (figs. 7a-7b) comprising:
a substrate 1;
solder pads with two sizes of diameters;
a plurality of first solder pads 2d positioned on a surface of the substrate, each of the first
20 solder pads having a first diameter; and
at least a second solder pad 2a positioned on a corner region of the substrate surface, the second solder pad having a second diameter greater than the first diameter. Since Ishii discloses all
25 claimed structure features. Therefore, the package inherently sustains a stronger thermal stress, a high stress region and a stronger fatigue strength.
- Regarding claim 5, Ishii discloses the substrate 1 comprises a chip (figs. 7a-7b).
- 30 ● Regarding claim 7, Ishii discloses the first solder pads are arranged in a matrix at a center region of the substrate.

- Regarding claim 16, Ishii discloses each of the first solder pad and the second solder comprise a solder ball pad 8a/8dd, the solder ball pad connecting to a solder ball to connect to a board
5 7 (figs. 9a-9b).

Response:

First, claim 1 is amended in the above AMENDMENTS
10 TO THE CLAIMS section to overcome this rejection. The feature introduced into the amended claim 1 is illustrated in Figs. 5-7, 10-11 of the present application. No new matter is introduced.

15 Second, the Applicant intends to point out the difference between the amended claim 1 of the present application and Ishii's disclosure. The amended claim 1 of the present application is repeated below:

20 Claim 1 (currently amended): Solder pads for improving reliability of a package, the package comprising a substrate, the solder pads with two sizes of diameters comprising:

25 **a plurality of first solder pads positioned on a surface of the substrate to occupy the entire surface of the substrate except the corners**, each of the first solder pads having a first diameter; and

30 **at least a second solder pad positioned on a corner region of the substrate surface, the second solder pad having a second diameter greater than the first diameter to sustain a stronger thermal stress and a stronger fatigue strength.**

As disclosed in the amended claim 1, the smaller first solder pads are positioned on the entire substrate surface except the corners, and the bigger second solder pad is positioned at the corner of the substrate surface. The present application positions the bigger solder pads only at the corners (the high stress region) of the substrate surface to sustain a stronger thermal stress and a stronger fatigue strength, and positions the smaller solder pads on the entire substrate except the corners to increase the bonding circuit density of the package as well.

Referring to Figs. 7a and 7b of Ishii's disclosure, however, the smaller first solder pads 2d are positioned at a small area of the substrate surface, instead of being positioned on the entire substrate except the corners. Ishii merely positions the smaller solder pads 2d at the center of the substrate surface to form bigger solder bumps 3d within the small area of the substrate. Ishii never specifically teaches to enlarge the solder pads at the corner and keeps all the other solder pads in small sizes so as to strengthen the package structure and keep high bonding circuit density, as are disclosed in the present application.

From the aforementioned reasons, the Applicant believes that the amended claim 1 of the present application is absolutely different from Ishii's disclosure. Reconsideration of the amended claim 1 is politely requested.

As claims 5, 7 and 16 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of claims 5, 7 and 16 is therefore requested.

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Claim 6 is canceled in the above AMENDMENTS TO THE CLAIMS section and has no need in consideration.

3. Response to the rejection of claims 2-4 and 13 under
10 **35 U.S.C. 103(a):**

Claims 2-4 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Guzuk et al. (U.S. Pat. 5153379).

15 Ishii discloses the claimed invention except for not specially point out that the substrate comprises a plastic substrate or a ceramic substrate.

Guzuk et al. disclose a semiconductor device comprising a substrate and wherein the substrate is
20 preferably a ceramic board, an insulating material such as glass epoxy board or a printed circuit board (column 2, lines 39-45). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Ishii
25 to increase the heat dissipating characteristics, as shown by Guzuk et al.

● Regarding claim 13, Guzuk et al. disclose the corner region comprises at least a grounded
30 solder pad (column 1, lines 66-67 and column 2, lines 5-6).

Response:

As claims 2-4 and 13 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of claims 2-4 and 13 is therefore requested.

4. Response to the rejection of claims 9-12 under 35 U.S.C. 103(a):

10 Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Applicant Admitted Prior Art (figs. 1 and 4).

15 ● Regarding claim 9, Ishii discloses the claimed invention except for not specifically point out that the corner region comprises the circumferences of a plurality of concentric circles on the substrate.

20 AAPA (fig. 4) disclose a plurality of first solder pads 14 and a plurality of second solder pads 24, the plurality of second solder pads 24 positioned on a corner region; wherein the corner region comprises the circumferences of a plurality of concentric circles on the substrate. Therefore, it would have been obvious to one

25 having ordinary skill in the art at the time the invention was made to modify the device of Ishii to prevent the package not crack easily at the corner of the chip.

30 ● Regarding claim 10, AAPA discloses the second solder pads on each of the concentric circle circumferences are arranged with an equal interval.

- Regarding claim 11, AAPA discloses the corner region comprises the corners of the substrate on an outside portion of a maximum circle on the substrate.
- 5 ● Regarding claim 12, AAPA discloses the corner region comprises the circumference of a maximum circle on the substrate.

Response:

10 Regarding claim 9, AAPA (Fig. 4) discloses a ring composed of first solder pads 14 and second solder pads 24. The first solder pads 14 and the second solder pads 24 have the same sizes. AAPA (Fig. 4) does not illustrate "a plurality of concentric circles" as are disclosed
15 in claim 9 and Fig. 11 of the present application. Since Ishii does not disclose "a plurality of concentric circles" either, the Applicant respectfully believes that one of ordinary skill cannot combine Ishii's invention with AAPA to accomplish the present
20 application. Reconsideration of claim 9 is politely requested.

 Regarding claim 11, AAPA (Fig. 4) does not illustrate any solder pads positioned on the corners "on an outside
25 portion of a maximum circle" on the substrate. Since Ishii does not disclose any solder pads positioned on the corners "on an outside portion of a maximum circle" on the substrate either, the Applicant respectfully believes that one of ordinary skill cannot combine
30 Ishii's invention with AAPA to accomplish the present application. Reconsideration of claim 11 is politely requested.

Claims 9-12 are dependent upon the amended claim 1 and should be allowed if the amended claim 1 is allowed. Reconsideration of claims 9-12 is therefore requested.

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5. Response to the rejection of claims 14-15 under 35 U.S.C. 103(a):

Claims 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii in view of Capote et al. (U.S. Pat. 6518677).

Ishii fails to disclose a solder bump pad and solder bumps and using the solder bump to connect to a chip.

Capote et al. disclose a semiconductor device comprising: plurality of solder pads 12 comprise a solder bump pad 24, the solder bump pad connecting to a solder bump 14 and using the solder bump to connect to a chip 10. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Ishii to provide a direct electrical connection through bumps reduces signal transmission path and high packaging density, as shown by Capote et al.

● Regarding claim 15, Capote et al. disclose an underfill layer 22 is filled in a gap between the chip and the substrate.

Response:

Claims 14-15 are dependent upon the amended claim 1 and should be allowed if the amended claim 1 is allowed. Reconsideration of claims 14-15 is therefore requested.

6. Response to the rejection of claims 17, 20-22 and 28-29 under 35 U.S.C. 103(a):

5 Claims 17, 20-22 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pu et al. (U.S. Pat. 6350669) in view of Ishii.

 Pu et al. discloses a semiconductor device (cover fig.) comprising:

10 a substrate 310;

 a plurality of first solder bump pads A2 positioned on a first surface of the substrate, each of the first solder bump pads having a first diameter and

 at least a second solder bump pad A1 positioned on
15 a first predetermined region of the first substrate, the second solder bump pad having a second diameter greater than the first diameter (column 4, lines 52-54), each of the first solder bump pads and the second solder bump pad being connected to a solder bump 321 that is
20 connected to a chip 300.

 Pu et al. fail to disclose a plurality of first solder ball pads positioned on a second surface of the substrate, each of the first solder ball pads having a third diameter, and at least a second solder ball pad positioned on
25 a second predetermined region of the second surface, the second solder ball pad having a second diameter greater than the third diameter.

 Ishii discloses a semiconductor device (figs. 7a-b) comprising:

30 a plurality of first solder ball pads 2d positioned on a second surface of the substrate 1, each of the first solder ball pads having a third diameter; and

at least a second solder ball 2a positioned on a second predetermined region of the second surface, the second solder ball pad having a fourth diameter greater than the third diameter, each of the first solder ball pads and the second solder ball pad being connected to a solder ball 3 that is connected to a circuit board 7 (figs. 9a-b). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Pu et al. to provide a high reliability for the semiconductor package device and relax the influence of distortion caused by difference in thermal expansion between the package and the mounting board, as shown by Ishii.

- Regarding claim 20, since Pu et al. and Ishii disclose all claimed structural features. Therefore, the package inherently comprises a high stress region at the first predetermined region and the second predetermined region.
- Regarding claims 21 and 28, Ishii discloses the small diameter pads are arranged in a matrix at a center region of the substrate.
- Regarding claims 22 and 29, Ishii discloses the predetermined region comprises the corners on the surface of the substrate.

Response:

As shown in Fig. 3C of Pu et al.'s disclosure, the BGA package 300 has a plurality of bond pads 301 with the same sizes, and the circuit board 310 has a plurality of bond pads 311 with the same sizes. Pu et al. discloses that the **pad joint area A1** of the first group of solder

balls 321 would be greater than the **pad joint area A2** of the second group pf solder balls 322 (Col. 4, lines 52-54), however, Pu et al. never discloses the **bond pads 301 or 311** have different diameters. The pad joint area A1, A2 taught by Pu et al. cannot be read as the pad area of the present application. The pad joint area A1 taught by Pu et al. refers to the joint area between the solder ball 321 and the solder pad 311, and the pad joint area A2 refers to the joint area between the solder ball 322 and the solder pad 311. Pu et al. uses materials of different melting point to form the solder ball 321 and the solder ball 322 (Col. 4, lines 24-26), so as to produce different joint areas A1 and A2 (Figs. 3B-3C, Col. 4, lines 27-55). Since Pu et al. never discloses solder pads with two sizes of diameters as are disclosed in claim 17 of the present application, the Applicant believes claim 17 of the present application is absolutely different from Pu et al.'s disclosure.

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In addition, Ishii teaches solder pads 2a, 2d with different sizes to connect to solder bumps 3a, 3d. However, Ishii never discloses solder pads with different sizes to connect to **solder balls**, as are disclosed in claim 17 of the present application.

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Since neither Pu et al. nor Ishii teaches solder pads with two different sizes to connect to solder balls, the Applicant therefore respectfully believes that one of ordinary skill cannot combine the inventions of Pu et al. and Ishii to accomplish the present application. Reconsideration of claim 17 is politely requested.

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As claims 20-22 and 28-29 are dependent upon claim 17, they should be allowed if claim 17 is allowed. Reconsideration of claims 20-22 and 28-29 is therefore
5 requested.

7. Response to the rejection of claims 18-19 under 35 U.S.C. 103(a):

10 Claims 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pu et al. (U.S. Pat. 6350669) in view of Ishii and further in view of Guzuk et al.

Pu et al. and Ishii disclose the claimed invention except for not specially point out that the substrate
15 comprises a plastic substrate or a ceramic substrate.

Guzuk et al. disclose a semiconductor device comprising a substrate and wherein the substrate is preferably a ceramic board, an insulating material such as glass epoxy board (column 2, lines 39-45). Therefore,
20 it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Pu et al. and Ishii to increase the heat dissipating characteristics, as shown by Guzuk et al.

25 Response:

As claims 18-19 are dependent upon claim 17, they should be allowed if claim 17 is allowed. Reconsideration of claims 18-19 is therefore requested.

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8. Response to the rejection of claims 18-19, 23-26 and 30-33 under 35 U.S.C. 103(a):

Claims 18-19, 23-26 and 30-33 are rejected under
35 U.S.C. 103(a) as being unpatentable over Pu et al.
in view of Ishii and further in view of Applicant Admitted
5 Prior Art (figs. 1 and 4).

- Regarding claims 23 and 30, Pu et al. and Ishii
disclose the claimed invention except for not
specifically point out that the predetermined
region comprises the circumferences of a
10 plurality of concentric circles on the substrate.
AAPA (fig. 4) disclose a plurality of first pads
14 and a plurality of second pads 24, the plurality
of second pads 24 positioned on predetermined
region; wherein the predetermined region
15 comprises the circumferences of a plurality of
concentric circles on the substrate. Therefore,
it would have been obvious to one having ordinary
skill in the art at the time the invention was
made to modify the device of Pu et al. and Ishii
20 to prevent the package not crack easily at the
corner of the chip.
- Regarding claims 18-19, AAPA (fig. 1) discloses
a substrate 18 comprises a plastic substrate or
a ceramic substrate.
- 25 ● Regarding claims 24 and 31, AAPA discloses the
second pads on each of the concentric circle
circumferences are arranged with an equal
interval.
- Regarding claims 25 and 32, AAPA discloses the
30 predetermined region comprises the corners of
the substrate on an outside portion of a maximum
circle on the substrate.

- Regarding claims 26 and 33, AAPA discloses the predetermined region comprises the circumference of a maximum circle on the substrate.

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Response:

Regarding claims 23 and 30, AAPA (Fig. 4) discloses a ring composed of first solder pads 14 and second solder pads 24. The first solder pads 14 and the second solder pads 24 have the same sizes. AAPA (Fig. 4) does not illustrate "a plurality of concentric circles" as are disclosed in claims 23, 30 and Fig. 11 of the present application. Since neither Pu et al. nor Ishii discloses "a plurality of concentric circles", the Applicant respectfully believes that one of ordinary skill cannot combine the inventions of Pu et al. and Ishii with AAPA to accomplish the present application. Reconsideration of claims 23 and 30 is politely requested.

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Regarding claims 25 and 32, AAPA (Fig. 4) does not illustrate any solder pads positioned on the corners "on an outside portion of a maximum circle" on the substrate. Since neither Pu et al. nor Ishii discloses any solder pads positioned on the corners "on an outside portion of a maximum circle" on the substrate, the Applicant respectfully believes that one of ordinary skill cannot combine the inventions of Pu et al. and Ishii with AAPA to accomplish the present application. Reconsideration of claims 25 and 32 is politely requested.

Claims 18-19, 23-26 and 30-33 are dependent upon claim 17 and should be allowed if claim 17 is allowed. Reconsideration of claims 18-19, 23-26 and 30-33 is therefore requested.

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9. Introduction to new claims 35-37:

Claims 35-37 are added to emphasize the outstanding feature of the present invention. The limitations of
10 claims 35-37 are entirely supported by the disclosure, and specifically, by Figs. 5-9, for instance.

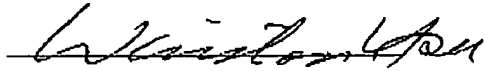
Claim 35 is dependent on claim 7 to emphasize that portions of the first solder pads are arranged out of
15 the rectangular array composed of other first solder pads.

Claim 36 is an independent claim to emphasize that the first solder pads and the second solder pads are
20 arranged in a ring and the second solder pads are positioned only at corners of the substrate.

Claim 37 is dependent on claim 36 to emphasize that a plurality of first solder pads are positioned within
25 the ring composed of the first solder pads and the second solder pads.

The outstanding feature stated in new claims 35-37 is not disclosed in the cited prior arts. Consideration
30 of new claims 35-37 is politely requested.

Sincerely yours,



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